Leslie Hanna

FY 1999 - FY 2000

Reclamation spillway and outlet works stilling basins have experienced significant abrasion damage caused by rock, gravel, and sand brought into the basins by reverse flow over the basin end sill as a result of the normal operation of a hydraulic jump energy dissipation basin. Material becomes trapped in the basin, where turbulent flow continually moves the material about the surface, causing severe damage to concrete. Often, abrasion damage has exposed reinforcing bars, and repairs have been made. However, the same damage occurs again within one or two operating seasons. Previous research in FY 1996 and FY 1997 by the Water Resources Research Laboratory (WRRL) has demonstrated that the installation of flow deflectors can improve flow distribution significantly and minimize or eliminate the potential for moving materials into the basin of stilling basins. If deflector designs can be generalized over a large range of operations, the installation of deflectors could mean a significant savings in terms of infrastructure repair.

Reclamation stilling basins designated as Type II and Type III basins have experienced the most extensive abrasion damage; therefore, these two types of basins will be investigated first. Previous studies on both types of basins have demonstrated that flow deflectors can be designed to be effective under certain flow conditions. The objectives of this study will be to (1) generalize designs of flow deflectors over large operating ranges and fluctuations in tailwater and
(2) to determine the limits in basin geometry and flow conditions for which the designs will be effective.
The objective for FY 1999 was to modify the stilling basin design for the Type III basin investigations and begin initial testing and video-taping with dye traces to determine the operating conditions and flow patterns within the basin that can lead to abrasion damage.

The stilling basin model was modified to reflect the geometry of a typical Type III stilling basin at a 1:9 geometric scale. This included replacing one of the side walls with a plexiglass viewing window for viewing basin flow patterns. Initial velocity and dye streak data have been taken over a wide range of operating conditions to determine which conditions set up flow patterns conducive to entrainment of materials within the basin. The analysis of these data will determine which conditions will be used for further testing with flow deflectors in place.

Although no partners participated directly in this project, widespread interest in the results from this research has been expressed from the regions, since many of them are experiencing this type of damage. (Some have also expressed interest in being involved during field testing.) In addition, as a result of this research, we have been consulted on several occasions in the past year for recommendations for specific projects currently experiencing abrasion damage (specifically Fontenelle River Outlet Works and Choke Canyon Dam outlet Works basin).

Hanna, Leslie J. October 1998. Choke Canyon Dam Outlet Works Stilling Basin Damage Assessment, PAP-800.

Hanna, Leslie J. June 1999. Memorandum, subject: Model Study Estimate for Fontenelle River Outlet Works Stilling Basin.

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